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Alteration In Serum Electrolytes In Burn Patients

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Abstract

Aim & Objectives: The aim of this study is to study the alterations in serum electrolytes for early diagnosis and management of burn injury and to prevent the patient's death.

Materials And Methods: In this study, 40 burn patients and 40 healthy controls of different age and sex were included. The analysis of biochemical parameters was done by using ABG (Arterial Blood Gas Analyzer).

Results: In the present study Mean of Serum Sodium and Chloride level was lower in burn patients than controls ($P < 0.001$) and Serum Potassium level was higher in Burn patients than controls ($P < 0.001$)

Conclusion: In India the incidence of burn injury and mortality rate is higher; therefore we attempt to study the alterations and prognostic importance of biochemical parameters in burn patients.

Keywords: ISE-Ion Selective Electrode, ABG-Arterial Blood Gas Analyzer, Na^+ - Sodium, K^+ - Potassium, Cl^- - Chloride.

Introduction:

Burn injuries are among the most devastating of all injuries and a major global public health crisis. (1,2) Burns are the fourth most common type of trauma worldwide.(3) Burn shock is the first consequence of deep and extensive burns and constitutes the main cause of mortality, if local and systemic treatments are not provided timely.(4) In 1998, India is the only country in the world where, fire(burn) was classified among the 15 leading causes of death. High mortality in young married women from burns has already become an alarming and contentious medical problem in rural India. (5) Despite many medical advances, burns continue to remain a challenging problem due to the lack of infrastructure and trained professionals as well as the increased cost of treatment. (6)

Burn injury destroys the water vapor barrier of the skin, and evaporative water loss from the burn area is markedly elevated.(7) After the burn injury plasma sodium falls and usually remains depressed through the shock stage and often during most the hyper metabolic stage of burn. The patients usually receive large sodium loads during resuscitation and may be positive sodium balance. At the same time patients show intense renal conservation of sodium during the shock stage and some of the hyper metabolic stage. It is possible that, this is the result of loss of sodium from the increased extracellular volume into the cells as a result of sodium pump activity impairment caused either by poor circulatory function leading to lowered tissue perfusion or to energy deficit.

The conservation of sodium is usually accompanied by increased urinary potassium loss; plasma levels may be slightly elevated but are rarely above the upper limits of the reference normal range. Increased potassium loss is probably mediated by the adrenal cortex, possibly through the effect of aldosterone, although it appears likely that loss as a result heat damage to tissue and potassium losses. Excess potassium may also be excreted during the hyper metabolic phase, as a muscle is catabolized. (8)

Material And Methods :

The present study was carried out in the department of Biochemistry, GMC, Miraj and P.V.P. General Hospital Sangli, during the period of 2008-2010. The study protocol was approved by Ethical Committee of Medical College Miraj.The study included 80 subjects of different age groups, out of which, 40 were patients with different types of burn injuries. Remaining 40 were normal healthy individuals showed no abnormality in clinical examination particularly the metabolic or nutritional disorders.

Sample collection: the blood is drawn from the radial artery; blood is taken with the help of resident doctors or nurses. Blood is then centrifuged at 3000 RPM for separation of serum. Separated serum is taken in a 1 ml syringe and used for the measurement of serum electrolytes.

With a view of obtaining more information regarding biochemical changes taking place and their role in the pathophysiology of burn injury, there is a need of a well-established fluid removal strategy in severely burned patients to avoid water and electrolyte imbalances. Serum electrolytes data can helpful to make the right decision about treatment and management of burn injury; therefore, we undertook the study to determine serum electrolytes in burn patients.

In this study serum electrolytes are measured by ion-selective electrode (ISE).An ISE measurements corresponds to the activity of the ion (it's dissociated or completely ionized fraction per unit volume of water) and not to its mass concentration (total amount, both ionized or un-ionized per unit volume of fluid).(9,10)

Distribution Of Study Subjects:

Group I	N = 40 Burn patients.
Group II	N = 40 Healthy controls.

Volume 5, Issue 3; May-June 2022; Page No 472-476

Results:

Table no. 1: The mean value of serum electrolytes in burn patients and controls.

Parameters	Patients (N==40) Mean ±SD	Controls (N==40) Mean ±SD	Significance
Na^+ mmol/L	125.30 ± 3.36	138.62 ± 2.39	P < 0.001
K^+ mmol/L	6.370 ± 0.479	4.04 ± 0.433	P < 0.001
Cl^- mmol/L	71.25 ± 8.46	102.82 ± 3.32	P < 0.001

The statistical method uses to compare data was 't' test.

*P> 0.05……Not Significant

**P<0.05……...Significant

***P<0.001…...Highly Significant

There is highly statistically significant difference in means of Na^+, K^+, Cl^- (P < 0.001) as compare to controls.

In the present study Mean value of biochemical parameters i. e. serum Na^+,Cl^- was significantly decreased , whereas serum K^+ level was significantly increased in burn patients as compared to controls.

Discussion :

Burns are one of the most devastating conditions encountered in medicine. The injury represents an assault on all aspects of the patient, from the physical to the physiological. It affects all ages, from babies to elderly people, and is a problem in both the developed and developing countries. (11)

Developing countries have a high incidence of burn injuries, creating formidable public health problem. High population density, illiteracy, and poverty are the main demographic factors associated with a high risk of burn injuries. (12) burns on > 10 % of the total body surface area are responsible for systemic problems, in which cases of very severe fluid volume abnormalities and electrolyte changes, can eventually lead to burn shock, and can represent vital risk. (13) The skin protects against fluid and electrolyte loss. Burn injury does affect skin integrity and protection against fluid loss. (14) Severe burn injuries induce capillary leak characterized by fluid deregulation and electrolyte imbalance. (14,15) In burn patient intravascular volume is lost in both burned and unburned tissues. This process is due to an increase in vascular permeability, increased interstitial osmotic pressure in burn tissue and cellular oedema. Hyponatraemia (< 135 mEq/L) is due to extracellular sodium depletion followed by changes in cellular permeability. Hyponatraemia is frequent and so the restoration of sodium loss in the burn tissue is necessary. (16) Measurement of serum sodium is not only a means of diagnosing dehydration, but it is a good guide for estimation and management of ongoing fluid loss.

In view of this we have to determine the study of changes in serum electrolyte balance in burn patients. In our study we observe highly significant decreased values of serum sodium and chloride (p< 0.001) as compared to controls, where-as highly significant increase was observed in serum potassium level when compared to controls (p< 0.001), said RA, Hussien MM (1987) and also observed hyponatraemia and hyperkalaemia in two burn victims (17).Kamoi. K, Soda S. et al (2004) observed that in thermal burn injury the patient admitted was dehydrated, which was evidenced by physical signs. The patient had hyponatremia with high excretion of urinary sodium. (18) A. V. Pogosava (1965) also found the same results (19). Recently a study done by Priyank udagani et al observed that, the patients with thermal injury showed slightly decreased serum sodium and chloride levels and increased potassium levels in burn patients as compared with controls. (20) Hauhout- Attoungbre ML, Mlan W. et al (2005) observed the elevation of potassium, decrease in sodium and moderate variations in chloride and

Volume 5, Issue 3; May-June 2022; Page No 472-476

magnesium in thermal burns. (21) Navarini A. Montanari A, et al (1982) also observed extracellular electrolytes and acid base disturbances in acute burn phase. (22) Study done by J.H. Anadani, who divided patients into groups (group 1: 20-40yr, group 2: 40-60yr) showed slight raise in potassium level (14% in Gp 1, 24% in Gp2) and 4% decrease in sodium level in both groups. (23)

Conclusion:

There is a systemic relevant transdermal fluid loss in burn wounds after severe burn injuries. Serum sodium concentration can be used to calculate need of fluid resuscitation for fluid maintenance. There is a need of a well-established fluid removal strategy in severely burned patients to avoid water electrolyte imbalance.

References:

1) Forjuoh, SN: Burns in low- and middle-income countries: a review of available literature on descriptive epidemiology risk factors, treatment and prevention. Burns: 2006; 32: 529.
2) Peck. MD, Kruger, AE, et al: Burns and Fires From non-electric domestic appliances in low- and middle-income countries part 1. The scope of the problem: Burns: 2008; 34: 303.\
3) World Health Organization. The Global Burden of Disease: 2004 Update. World health organization Geneva 2008 Available online at: www.who.int/healthin fo/ global burden disease/ GBD report 2004 update full. Pdf (Accessed on April, 2010).
4) Dauti L. Andrea A., Osman X. H., Hydroelectrolytic disturbances in burn patients during the emergency period and their treatments: Annals of Burns and fire Disasters: September 1996; (IX) n-3.
5) Anil K Batra: Burn Mortality: recent trends and sociocultural determinants in rural India: May 2003; (29) 3: 270-275.
6) R. Raja Shanmugakrishnan, V. Narayanan, et al: Epidemiology of burns in a teaching hospital in south India; Indian Journal of Plastic Surgery: Jan- June 2008; 41 (1): 34-37.
7) Basil A. Pruitt, Cleon W. Goodwin et al Burns-including cold, chemical, and Electric injuries; Sabiston: Texbook of surgery the biological basis of modern surgical practice; Fifteenth Edition : 1999; (1); 221-250.
8) Batstone GF. Et al: Metabolic studies in subjects following thermal injury. Intermediatery metabolites, hormone and tissue oxygenation: Burns: 1976; 2: 207-225.
9) Mass, A. H. J. Siggaard- Andersen O., Weisherg, H. F. et al: Ion- selective electrodes for sodium and potassium: A new problem of what is measured and what should be reported: clin. Chem: 1985; 31: 484.
10) Levy, G.B: Determination of sodium with ion-selective electrodes: clin. Chem: 1981; 27: 1435.
11) Shehan Hettiaratchy, Peter Dziewulski: Introduction: BMJ: 2004; 328.
12) Maria Jose Bello, Esther Rodriguez et al: Transient cardiac arrest; Applied Radiology: 2007; 36(12).
13) Stephanie Jewett, RN: Burn stages and burn unit nursing: March 2010.
14) Herndon T. Total Burn Care; Third ed: 2007; philladelphia; saunders.
15) Jarrett F, Ellerbe S: Acute leukopenia during topical burn therapy with silver sulfadiazine; Am J Surg: 1978; 135(6): 818-19.
16) Marc GJ. The Hepatic Response to Thermal Injury: Is the LiverImportant for Postburn Outcomes? Mol Med. 2009; 15(9):337–351.
17) Said RA., Hussein MM.: Severe hyponatremia in burn patients secondary to hydrotherapy: Burn Incl Therm Inj: Aug 1987; 13(4): 327-9.
18) Kamoi K, Soda S. et al: Hypernatremia secondary to multiple etiologies a case report; J Med: 2004; 35(1-6): 125-140.
19) A. V. Pogosava: Variation of the electrolyte content in the organs and tissue during experimental burn disease and under the influence of amino acid loading; Translated from Byulleten Eksperimenal not Biologii I Meditsiny: july1965; 60 No. 7:61-64.

Volume 5, Issue 3; May-June 2022; Page No 472-476

20) Priyank Udagani, Vibha C et al: Impact of thermal injury on liver function test and serum electrolytes: Its role in management; International Journal of Clinical Biochemistry and research: 2019; 6(4): 553-557.

21) Hauhouot- Attoungbre ML, Mlan WC et al: Disturbances of electrolytes in severe thermal burns; Ann Biol Clin (paris): Aug 2005; 63(4): 417-21.

22) Navarini A, Montanari A, et al: Muscle tissue electrolytes in burned subjects: Burns Ind Therm Inj: Jan 1882; 8(3): 210-4.

23) Anadani JH. Impact of Thermal Injury on Hematological and Biochemical Parameters in Burn patients. Biosci Biotech Res Comm. 2010; 3(1):97–100.

Volume 5, Issue 3; May-June 2022; Page No 472-476